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Computational Homology in Rayleigh-Benard convection experiments[1] HUSEYIN KURTULDO, MICHAEL SCHATZ, MARCIO GAMEIRO, KONSTANTIN MISCHAIKOW, Georgia Institute of Technology, SANTIAGO MADRUGA, Northwestern University, KAPILANJAN KRISHAN, University of California, Irvine — Computational homology is used to analyze spatial structures of spiral defect chaos (SDC) in Rayleigh-Benard convection (RBC) experiments. Geometric structures composed of hot (up) and cold (down) flows in SDC are visualized by a shadowgraph system producing images used to compute the homology of the rolls. The analysis of experimental data yields Betti numbers, which count the number of connected components and holes of the hot and cold flow regions in the images. The homology is used to detect symmetry breakings between up and down flows (Non-Boussinesq effects) in SDC. The probability distribution and sequence of Betti numbers at different parameter values are used for identifying and characterizing different attractors and states of SDC.

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